Andhra Pradesh State Council of Higher Education
B.Sc. PHYSICS SYLLUBUS UNDER CBCS
w.e.f. 2015-16 (Revised in April 2016)

First Semester
Paper I : Mechanics & Properties of Matter
Practical I (Lab-1)

Second Semester
Paper II: Waves & Oscillations
Practical 2 (Lab2)

Third Semester
Paper III: Wave Optics
Practical 3. (Lab 3)

Fourth Semester
Paper IV: Thermodynamics & Radiation Physics
Practical 4.(Lab 4)

Fifth Semester
Paper V: Electricity, Magnetism & Electronics
Paper VI: Modern Physics
Practical 5.(Lab 5)
Practical 6.(Lab 6)

Sixth Semester
PaperVII: Elective (One)
Paper VIII: Cluster Electives (Three)
Practical 7 (Lab 7)
Practical 8 (Lab 8)

Proposed Electives in Semester - VI

Paper – VII (one elective is to be chosen from the following)

Paper VII-(A): Analog and Digital Electronics
Paper VII-(B): Materials Science
Paper VII-(C): Renewable Energy

Paper – VIII (one cluster of electives (A-1,2,3 or B-1,2,3 or C-1,2,3) to be chosen *preferably* relating to the elective chosen under paper – VII (A or B or C)

Cluster 1
Paper VIII-A-1. Introduction to Microprocessors and Microcontrollers
Paper VIII-A-2.Computational Physics and Programming
Paper VIII-A-3. Electronic Instrumentation

Cluster 2

Paper VIII-B-1.Fundamentals of Nanoscience
Paper VIII-B-2.Synthesis and Characterization of Nanomaterials
Paper VIII-B-3.Applications of Nanomaterials and Devices

Cluster 3

Paper VIII-C-1.Solar Thermal and Photovoltaic Aspects
Paper VIII-C-2.Wind, Hydro and Ocean Energies
Paper VIII-C-3.Energy Storage Devices

NOTE: Problems should be solved at the end of every chapter of all Units.

1. Each theory paper is of 100 marks and practical paper is also of 50 marks.
   Each theory paper is 75 marks University Exam (external) + 25 marks mid Semester Exam (internal). Each practical paper is 50 marks external
2. The teaching work load per week for semesters I to VI is 4 hours per paper for theory And 2 hours for all laboratory (practical) work.
3. The duration of the examination for each theory paper is 3.00 hrs.
4. The duration of each practical examination is 3 hrs with 50 marks, which are to be distributed as30 marks for experiment
   10 marks for viva
   10 marks for record

Practicals	**50 marks**
Formula & Explanation	6
Tabular form +graph +circuit diagram	6
Observations	12
Calculation, graph, precautions & Result	6
Viva-Voce	10
Record	10

***NOTE: Practical syllabus is same for both Mathematics and Non Mathematics combinations**

B.Sc. (Physics) (Maths Combinations)

Scheme of instruction and examination to be followed w.e.f. 2015-2016

S. No	Semester	Title of the paper	Instruc-tion hrs/week	Duration of exam(hrs)	Max Marks (external)
		Thoery			
1	First	Paper I: Mechanics& Properties of Matter	4	3	75
2	Second	Paper II: Waves & Oscillations	4	3	75
3	Third	Paper III: Wave Optics	4	3	75
4	Fourth	Paper IV: Thermodynamics & Radiation Physics	4	3	75
5	Fifth	Paper V:Electricity, Magnetism& Electronics Paper VI: Modern Physics	4 4	3 3	75 75
6	Sixth	PaperVII :Elective (One) Paper VIII: Cluster Electives (Three)	4 4	3 3	75 75
		Practicals			
1	First	Practical 1	2	3	50
2	Second	Practical II	2	3	50
3	Third	Practical III	2	3	50
4	Fourth	Practical IV	2	3	50
5	Fifth	Practical V	2	3	50
6		Practical VI	2	3	50
7	Sixth	Practical VII	2	3	50
8		Practical VIII	2	3	50

Model question Paper for all theory papers

Time : 3 hrs **Max marks: 75**

Section-A (Essay type)

Answer All questions with internal choice from all units Marks: 10x5 = 50

(Two questions are to be set from each unit with either or type)

Section-B (Short answer type)

Answer any three out of 5 questions from all units (I to V) Marks: 5 x3 = 15

At least one question should be set from each unit.

Section-C

Answer any two out of 5 questions set from all units Marks: 5x2 = 10

Paper VII-(B) Elective (Materials Science)

Semester –VI
Elective Paper –VII-(B): Materials Science

No. of Hours per week: 04 **Total Lectures:60**

UNIT-I (12 hrs)
1.Materials and Crystal Bonding: Materials, Classification, Crystalline, Amorphous, Glasses; Metals, Alloys, Semiconductors, Polymers, Ceramics, Plastics, Bio-materials, Composites, Bulk and nanomaterials. Different types of chemical bonds – Ionic covalent bond or homopolar bond – Metallic bond – Dispersion bond – Dipole bond – Hydrogen bond – Binding energy of a crystal.

UNIT-II (12 hrs)
2. Defects and Diffusion in Materials: Introduction – Types of defects - Point defects- Line defects- Surface defects- Volume defects- Production and removal of defects- Deformation- irradiation- quenching- annealing- recovery. Diffusion in solids- Fick's laws of diffusion.

UNIT-III(12 hrs)
3. Mechanical Behavior of Materials: Different mechanical properties of engineering materials – Creep – Fracture – Technological properties – Factors affecting mechanical properties of a material – Heat treatment - Cold and hot working – Types of mechanical tests – Deformation of metals.

UNIT-IV (12 hrs)
4. Magnetic Materials: Dia-, Para-, Ferri- and Ferromagnetic materials, Classical Langevin theory of dia magnetism. Curie's law, Weiss's theory of ferromagnetism, Ferromagnetic domains. Discussion of B-H Curve. Hysteresis and energy Loss.

UNIT-V (12 hrs)
5. Dielectric Materials: Dielectric constant, dielectric strength and dielectric loss, polarizability, mechanism of polarization, factors affecting polarization, polarization curve and hysteresis loop, types of dielectric materials, applications; ferroelectric, piezoelectric and pyroelectric materials, Clausius -Mosotti equation.

Reference books
1. Materials Science by M. Arumugam, Anuradha Publishers. 1990, Kumbakonam.
2. Materials Science and Engineering V. Raghavan, Printice Hall India Ed. V 2004. New Delhi.
3. Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
4. Solid State Physics, M.A. Wahab, 2011, Narosa Publications

Elective Paper-VII-B Practical: Materials Science **2hrs/Week**

Minimum of 6 experiments to be done and recorded

1. Measurement of susceptibility of paramagnetic solution (Quinck`s Tube Method)
2. Measurement of magnetic susceptibility of solids.
3. Determination of coupling coefficient of a piezoelectric crystal.
4. Measurement of the dielectric constant of a dielectric Materials
5. Study the complex dielectric constant and plasma frequency of metal using surface Plasmon resonance (SPR)
7. Study the hysteresis loop of a Ferroelectric Crystal.
8. Study the B-H curve of 'Fe' using solenoid and determine energy loss from hysteresis.
9. Energy gap of a metaloxide semiconductor (thermistor).
10. Determination of activation energy using creep method.
11. Determination of crystallite size of given polycrystalline materials using x-ray diffractogram.

Semester –VI: Cluster Electives – VIII-B
Cluster Elective Paper VIII-B-1: Fundamentals of Nanoscience

No. of Hours per week: 04 **Total Lectures: 60**

UNIT-I (12hrs)

1. Background and history: Emergence of Nanoscience with special reference to Feynman and Drexler; Role of particle size; Spatial and temporal scale; Concept of confinement, strong and weak confinement with suitable example; Development of quantum structures, Basic concept of quantum well, quantum wire and quantum dot.

Size dependence of properties, crystal structures, Lattice vibrations, Energy bands:- Insulators Semiconductors and conductors.

UNIT-II (12hrs)

2. Classification of Nanomaterials: Inorganic nanomaterials: carbon nanotubes and cones, Organic nanomaterials: dendrimers, micelles, liposomes, block copolymers; Bionanomaterials: Biomimtric, bioceramic and nanotherapeutics; Nanomaterials for molecular electronics and optoelectronics.

UNITS-III (12hrs)

3. Macromolecules: Classification of polymers, chemistry of polymerization, chain polymerization, step polymerization, coordination polymerization. Molecular weight of polymers-number average and weight average molecular weight, degree of polymerization, determination of molecular weight of polymers by viscometry. Preparation and application of polyethylene, PVC, Teflon.

UNIT-IV (12hrs)

4. Molecular & Nanoelectronics: Semiconductors, Transition from crystal technology to nanotechnology. Tiny motors, Gyroscopes and accelerometers. Nano particle embedded wrinkle resistant cloth, Transparent Zinc Oxide sun screens. Bio-systems, Nanoscale processes in environment. Nanoscale structures and quantum computing. Single electron transistors.

UNIT-V (12hrs)

5. Biomaterials: Implant materials: Stainless steels and its alloys, Ti and Ti based alloys, Ceramic implant materials; Hydroxyapatite glass ceramics, Carbon Implant materials, Polymeric Implant materials, Soft tissue replacement implants, Sutures, Surgical tapes and adhesives, heart valve implants, Artificial organs, Hard Tissue replacement Implants, Internal Fracture Fixation Devices, Wires, Pins, and Screws, Fracture Plates.

Reference Books

1. T. Pradeep: Textbook of Nanoscience and Nanotechnology Chapter (McGraw-Hill Professional, 2012), Access Engineering.
2. C. N. R. Rao, A. Mu¨ller, A. K. Cheetham, "The Chemistry of Nanomaterials :Synthesis, Properties and Applications", Wiley-VCH, 2006.
3. C. Breachignac P. Houdy M. Lahmani, "Nanomaterials and Nanochemistry", Springer, 2006.
4. Guozhong Cao, "Nanostructures and Nanomaterials: Synthesis, Properties, and Applications", World Scientific Publishing Private, Ltd., 2011.
5. Zhong Lin Wang, "Characterization of Nanophase Materials", Wiley-VCH, 2004.
6. Carl C. Koch, "Nanostructured Materials: Processing, Properties and Potential Applications", William Andrew Publishing Norwich, 2006.

Elective Paper- VIII-B-1: Practical: Fundamentals of Nanoscience 2hrs/Week

A project based on any of the concepts of Fundamentals of Nanoscience covered in the theory paper (VIII-B-1)

Semester –VI

Cluster Elective Paper –VIII-B-2: Synthesis and Characterization of Nanomaterials

No. of Hours per week: 04 **Total Lectures: 60**

Unit-I (12 hrs)

1. Nanomaterials synthesis: Synthesis and nanofabrication, Bottom-Up and Top-Down approach with examples. Chemical precipitation methods, sol-gel method, chemical reduction, hydrothermal, process. Physical Mehtods- ball milling, Physical Vapour deposition (PVD), Sputtering, Chemical Vapor deposition (CVD), spray pyrolysis, Biological methods- Synthesis using micro organisms and bacteria, Synthesis using plant extract.

Unit-II (12 hrs)

2. Classification of materials: Types of materials, Metals, Ceramics (Sand glasses) polymers, composites, semiconductors. Metals and alloys- Phase diagrams of single component, binary and ternary systems, diffusion, nucleation and growth. Mechanical properties. Metallic glasses. Preparation, structure and properties like electrical, magnetic, thermal and mechanical, applications.

UNITS-III (12 hrs)

3. Glasses: The glass transition - theories for the glass transition, Factors that determine the glass-transition temperature. Glass forming systems and ease of glass formation, preparation of glass materials. Applications of Glasses: Introduction: Electronic applications, Electrochemical applications, optical applications, Magnetic applications.

UNITS-IV (12 hrs)

4. Liquid Crystals: Mesomorphism of anisotropic systems, Different liquid crystalline phase and phase transitions, Thermal and electrical properties of liquid crystals, Types Liquid Crystals displays, few applications of liquid crystals.

UNITS-V (12 hrs)

5. Characterization Methods: XRD, SEM, TEM, AFM, XPS and PL characterization techniques for nano materials. Electrical and mechanical properties, Optical properties by IR and Raman Spectroscopy.

References books

1. Encyclopedia of Nanotechnology by M.Balakrishna Rao and K.Krishna Reddy, Vol.I to X, Campus books.
2. Nano: The Essentials-Understanding Nanoscinece & Nanotechnology by T.Pradeep; Tata Mc. Graw Hill
3. Nanotechnology in Microelectronics & Optoelectronics, J.M Martine Duart, R.J Martin Palma, F. Agullo Rueda, Elsevier
4. Nanoelectronic Circuit Design, N.K Jha, D Chen, Springer
5. Handbook of Nanophysics- Nanoelectronics & Nanophotonics, K.D Sattler, CRC Press
6. Organic Electronics-Sensors & Biotechnology- R. Shinar & J. Shinar, McGraw-Hill.

Cluster Elective Paper- VIII-B-2: Practical: Synthesis and Characterization of Nanomaterials **2hrs/Week**

Minimum of 6 experiments to be done and recorded

1. Synthesis of nanocrystalline films of II-VI compounds doped with rare earths by chemical process.
2. Synthesis of Alkaline earth aluminates in nanocrystalline form by combustion synthesis.
3. Preparation of surface conducting glass plate by spray pyrolysis method
4. Preparation of surface conducting glass plate by chemical route
5. Fabrication of micro fluidic nanofilter by polymerisation reaction
6. Absorption studies on the nanocrystalline films and determination of absorption coefficient.
7. Determination of band gap from the absorption spectra using Tauc's plots.
8. Study of Hall effect in semiconductors and its application in nanotechnology.
9. Measurement of electrical conductivity of semiconductor film by Four Probe method and study of temperature variation of electrical conductivity.
10. Determination of the Band Gap of Semiconductor Nanoparticles.

Semester –VI

Cluster Elective Paper –VIII-B-3: Applications of Nanomaterials and Devices

No. of Hours per week: 04 **Total Lectures: 60**

UNIT-I (12 hrs)

1. Optical properties: Coulomb interaction in nanostructures. Concept of dielectric constant for nanostructures and charging of nanostructure. Quasi-particles and excitons. Excitons in direct and indirect band gap semiconductor nanocrystals. Quantitative treatment of quasi-particles and excitons, charging effects. Radiative processes: General formalization-absorption, emission and luminescence. Optical properties of heterostrctures and nanostructures.

UNIT-II (12 hrs)

2. Electrical transport:

Carrier transport in nanostrcutures. Hall effect, determination of carrier mobility and carrier concentration; Coulomb blockade effect, thermionic emission, tunneling and hoping conductivity. Defects and impurities: Deep level and surface defects.

UNIT-III (12 hrs)

3. Applications: Applications of nanoparticles, quantum dots, nanowires and thin films for photonic devices (LED, solar cells). Single electron transfer devices (no derivation). CNT based transistors. Nanomaterial Devices: Quantum dots heterostructures lasers, optical switching and optical data storage. Magnetic quantum well; magnetic dots - magnetic data storage. Micro Electromechanical Systems (MEMS), Nano Electromechanical Systems (NEMS).

UNIT-IV(12 hrs)

4. Nanoelectronics: Introduction, Electronic structure of Nanocrystals, Tuning the Band gap of Nanoscale semiconductors, Excitons, Quantum dot, Single electron devices, Nanostructured ferromagnetism, Effect of bulk nanostructuring of magnetic properties, Dynamics of nanomagnets, Nanocarbon ferromagnets, Giant and colossal magneto-resistance, Introduction of spintronics, Spintronics devices and applications.

UNIT-V (12 hrs)

5. Nanobiotechnology and Medical application: Introduction, Biological building blocks- size of building blocks and nanostructures, Peptide nanowires and protein nanoparticles, DNA double nanowires, Nanomaterials in drug delivery and therapy, Nanomedicine, Targeted gold nanoparticles for imaging and therapy.

Reference books:

1.C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.).
2.S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publishing Company).
3. K.K. Chattopadhyay and A.N. Banerjee, Introduction to Nanoscience & Technology (PHI Learning Private Limited).
4. Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).

Cluster Elective Paper-VIII-B-3: Practical: Applications of Nanomaterials and Devices 2hrs/Week

Minimum of 6 experiments to be done and recorded

1. Synthesis of metal nanoparticles by chemical route.
2. Synthesis of semiconductor nanoparticles.
3. Surface Plasmon study of metal nanoparticles by UV-Visible spectrophotometer.
4. XRD pattern of nanomaterials and estimation of particle size.
5. To study the effect of size on color of nanomaterials.
6. Prepare a disc of ceramic of a compound using ball milling, pressing and sintering, and study its XRD.
7. Fabricate a thin film of nanoparticles by spin coating (or chemical route) and study transmittance spectra in UV-Visible region.
8. Fabricate a pn-diode by diffusing Al over the surface of n-type Si and study its I-V characteristics.

B.Sc. (Physics) (Non-Mathematics Combinations)
Scheme of instruction and examination to be followed w.e.f. 2016-2017

S.No	Semester	Title of the paper	Instruction Hrs/week	Duration o f exam (hrs)	Max Marks (external)
Theory					
1	First	Paper I: Mechanics & Properties of Matter	4	3	75
2	Second	Paper II: Waves & Oscillations	4	3	75
3	Third	Paper III: Optics	4	3	75
4	Fourth	Paper IV: Thermodynamics & Radiation Physics	4	3	75
5	Fifth	Paper V: Electricity, Magnetism & electronics Paper VI: Modern Physics & Medical Physics	4 4	3 3	75 75
6	Sixth	PaperVII : Elective Paper VIII: Cluster Electives	4 4	3 3	75 75
Practical					
1	First	Practical 1	2	3	50
2	Second	Practical II	2	3	50
3	Third	Practical III	2	3	50
4	Fourth	Practical IV	2	3	50
5	Fifth	Practical V	2	3	50
6		Practical VI	2	3	50
7	Sixth	Practical VII	2	3	50
8		Practical VIII	2	3	50

B.Sc. Physics under CBCS for Non-Mathematics Combinations

w.e.f. 2015-16 (Revised in April, 2016)

Paper VII-(B) Elective (Materials Science)

Semester –VI

Elective Paper –VII-(B): Materials Science

No. of Hours per week: 04 **Total Lectures:60**

UNIT-I (12 hrs)

1.Materials and Crystal Bonding: Materials, Classification, Crystalline, Amorphous, Glasses; Metals, Alloys, Semiconductors, Polymers, Ceramics, Plastics, Bio-materials, Composites, Bulk and nanomaterials. Different types of chemical bonds – Ionic covalent bond or homopolar bond – Metallic bond – Dispersion bond – Dipole bond – Hydrogen bond – Binding energy of a crystal.

UNIT-II (12 hrs)

2. Defects and Diffusion in Materials: Introduction – Types of defects - Point defects- Line defects- Surface defects- Volume defects- Production and removal of defects- Deformation- irradiation- quenching- annealing- recovery. Diffusion in solids- Fick's laws of diffusion.

UNIT-III(12 hrs)

3. Mechanical Behavior of Materials: Different mechanical properties of engineering materials – Creep – Fracture – Technological properties – Factors affecting mechanical properties of a material – Heat treatment - Cold and hot working – Types of mechanical tests – Deformation of metals.

UNIT-IV (12 hrs)

4. Magnetic Materials: Dia-, Para-, Ferri- and Ferromagnetic materials, Classical Langevin theory of dia magnetism. Curie's law, Weiss's theory of ferromagnetism, Ferromagnetic domains. Discussion of B-H Curve. Hysteresis and energy Loss.

UNIT-V (12 hrs)

5. Dielectric Materials: Dielectric constant, dielectric strength and dielectric loss, polarizability, mechanism of polarization, factors affecting polarization, polarization curve and hysteresis loop, types of dielectric materials, applications; ferroelectric, piezoelectric and pyroelectric materials, Clausius -Mosotti equation.

Reference books

1. Materials Science by M. Arumugam, Anuradha Publishers. 1990, Kumbakonam.
2. Materials Science and Engineering V. Raghavan, Printice Hall India Ed. V 2004. New Delhi.
3. Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
4. Solid State Physics, M.A. Wahab, 2011, Narosa Publications

Elective Paper-VII-B Practical: Materials Science **2hrs/Week**

Minimum of 6 experiments to be done and recorded

1. Measurement of susceptibility of paramagnetic solution (Quinck`s Tube Method)
2. Measurement of magnetic susceptibility of solids.
3. Determination of coupling coefficient of a piezoelectric crystal.
4. Measurement of the dielectric constant of a dielectric Materials
5. Study the complex dielectric constant and plasma frequency of metal using surface Plasmon resonance (SPR)
7. Study the hysteresis loop of a Ferroelectric Crystal.
8. Study the B-H curve of 'Fe' using solenoid and determine energy loss from hysteresis.
9. Energy gap of a metaloxide semiconductor (thermistor).
10. Determination of activation energy using creep method.
11. Determination of crystallite size of given polycrystalline materials using x-ray diffractogram.

Semester –VI: Cluster Electives – VIII-B
Cluster Elective Paper VIII-B-1: Fundamentals of Nanoscience

No. of Hours per week: 04 **Total Lectures: 60**

UNIT-I (12hrs)

1. Background and history: Emergence of Nanoscience with special reference to Feynman and Drexler; Role of particle size; Spatial and temporal scale; Concept of confinement, strong and weak confinement with suitable example; Development of quantum structures, Basic concept of quantum well, quantum wire and quantum dot.

Size dependence of properties, crystal structures, Lattice vibrations, Energy bands:- Insulators Semiconductors and conductors.

UNIT-II (12hrs)

2. Classification of Nanomaterials: Inorganic nanomaterials: carbon nanotubes and cones, Organic nanomaterials: dendrimers, micelles, liposomes, block copolymers; Bionanomaterials: Biomimtric, bioceramic and nanotherapeutics; Nanomaterials for molecular electronics and optoelectronics.

UNITS-III (12hrs)

3. Macromolecules: Classification of polymers, chemistry of polymerization, chain polymerization, step polymerization, coordination polymerization. Molecular weight of polymers-number average and weight average molecular weight, degree of polymerization, determination of molecular weight of polymers by viscometry. Preparation and application of polyethylene, PVC, Teflon.

UNIT-IV (12hrs)

4. Molecular & Nanoelectronics: Semiconductors, Transition from crystal technology to nanotechnology. Tiny motors, Gyroscopes and accelerometers. Nano particle embedded wrinkle resistant cloth, Transparent Zinc Oxide sun screens. Bio-systems, Nanoscale processes in environment. Nanoscale structures and quantum computing. Single electron transistors.

UNIT-V (12hrs)

5. Biomaterials: Implant materials: Stainless steels and its alloys, Ti and Ti based alloys, Ceramic implant materials; Hydroxyapatite glass ceramics, Carbon Implant materials, Polymeric Implant materials, Soft tissue replacement implants, Sutures, Surgical tapes and adhesives, heart valve implants, Artificial organs, Hard Tissue replacement Implants, Internal Fracture Fixation Devices, Wires, Pins, and Screws, Fracture Plates.

Reference Books

1. T. Pradeep: Textbook of Nanoscience and Nanotechnology Chapter (McGraw-Hill Professional, 2012), Access Engineering.
2. C. N. R. Rao, A. Mu¨ller, A. K. Cheetham, "The Chemistry of Nanomaterials :Synthesis, Properties and Applications", Wiley-VCH, 2006.
3. C. Breachignac P. Houdy M. Lahmani, "Nanomaterials and Nanochemistry", Springer, 2006.
4. Guozhong Cao, "Nanostructures and Nanomaterials: Synthesis, Properties, and Applications", World Scientific Publishing Private, Ltd., 2011.
5. Zhong Lin Wang, "Characterization of Nanophase Materials", Wiley-VCH, 2004.
6. Carl C. Koch, "Nanostructured Materials: Processing, Properties and Potential Applications", William Andrew Publishing Norwich, 2006.

Elective Paper- VIII-B-1: Practical: Fundamentals of Nanoscience 2hrs/Week

A project based on any of the concepts of Fundamentals of Nanoscience covered in the theory paper (VIII-B-1)

Semester –VI

Cluster Elective Paper –VIII-B-2: Synthesis and Characterization of Nanomaterials

No. of Hours per week: 04 **Total Lectures: 60**

Unit-I (12 hrs)

1. Nanomaterials synthesis: Synthesis and nanofabrication, Bottom-Up and Top-Down approach with examples. Chemical precipitation methods, sol-gel method, chemical reduction, hydrothermal, process. Physical Mehtods- ball milling, Physical Vapour deposition (PVD), Sputtering, Chemical Vapor deposition (CVD), spray pyrolysis, Biological methods- Synthesis using micro organisms and bacteria, Synthesis using plant extract.

Unit-II (12 hrs)

2. Classification of materials: Types of materials, Metals, Ceramics (Sand glasses) polymers, composites, semiconductors. Metals and alloys- Phase diagrams of single component, binary and ternary systems, diffusion, nucleation and growth. Mechanical properties. Metallic glasses. Preparation, structure and properties like electrical, magnetic, thermal and mechanical, applications.

UNITS-III (12 hrs)

3. Glasses: The glass transition - theories for the glass transition, Factors that determine the glass-transition temperature. Glass forming systems and ease of glass formation, preparation of glass materials. Applications of Glasses: Introduction: Electronic applications, Electrochemical applications, optical applications, Magnetic applications.

UNITS-IV (12 hrs)

4. Liquid Crystals: Mesomorphism of anisotropic systems, Different liquid crystalline phase and phase transitions, Thermal and electrical properties of liquid crystals, Types Liquid Crystals displays, few applications of liquid crystals.

UNITS-V (12 hrs)

5. Characterization Methods: XRD, SEM, TEM, AFM, XPS and PL characterization techniques for nano materials. Electrical and mechanical properties, Optical properties by IR and Raman Spectroscopy.

References books

1. Encyclopedia of Nanotechnology by M.Balakrishna Rao and K.Krishna Reddy, Vol.I to X, Campus books.
2. Nano: The Essentials-Understanding Nanoscinece & Nanotechnology by T.Pradeep; Tata Mc. Graw Hill
3. Nanotechnology in Microelectronics & Optoelectronics, J.M Martine Duart, R.J Martin Palma, F. Agullo Rueda, Elsevier
4. Nanoelectronic Circuit Design, N.K Jha, D Chen, Springer
5. Handbook of Nanophysics- Nanoelectronics & Nanophotonics, K.D Sattler, CRC Press
6. Organic Electronics-Sensors & Biotechnology- R. Shinar & J. Shinar, McGraw-Hill.

Cluster Elective Paper- VIII-B-2: Practical: Synthesis and Characterization of Nanomaterials **2hrs/Week**

Minimum of 6 experiments to be done and recorded

1. Synthesis of nanocrystalline films of II-VI compounds doped with rare earths by chemical process.
2. Synthesis of Alkaline earth aluminates in nanocrystalline form by combustion synthesis.
3. Preparation of surface conducting glass plate by spray pyrolysis method
4. Preparation of surface conducting glass plate by chemical route
5. Fabrication of micro fluidic nanofilter by polymerisation reaction
6. Absorption studies on the nanocrystalline films and determination of absorption coefficient.
7. Determination of band gap from the absorption spectra using Tauc's plots.
8. Study of Hall effect in semiconductors and its application in nanotechnology.
9. Measurement of electrical conductivity of semiconductor film by Four Probe method and study of temperature variation of electrical conductivity.
10. Determination of the Band Gap of Semiconductor Nanoparticles.

Semester –VI

Cluster Elective Paper –VIII-B-3: Applications of Nanomaterials and Devices

No. of Hours per week: 04 **Total Lectures: 60**

UNIT-I (12 hrs)

1. Optical properties: Coulomb interaction in nanostructures. Concept of dielectric constant for nanostructures and charging of nanostructure. Quasi-particles and excitons. Excitons in direct and indirect band gap semiconductor nanocrystals. Quantitative treatment of quasi-particles and excitons, charging effects. Radiative processes: General formalization-absorption, emission and luminescence. Optical properties of heterostrctures and nanostructures.

UNIT-II (12 hrs)

2. Electrical transport:

Carrier transport in nanostrcutures. Hall effect, determination of carrier mobility and carrier concentration; Coulomb blockade effect, thermionic emission, tunneling and hoping conductivity. Defects and impurities: Deep level and surface defects.

UNIT-III (12 hrs)

3. Applications: Applications of nanoparticles, quantum dots, nanowires and thin films for photonic devices (LED, solar cells). Single electron transfer devices (no derivation). CNT based transistors. Nanomaterial Devices: Quantum dots heterostructures lasers, optical switching and optical data storage. Magnetic quantum well; magnetic dots - magnetic data storage. Micro Electromechanical Systems (MEMS), Nano Electromechanical Systems (NEMS).

UNIT-IV(12 hrs)

4. Nanoelectronics: Introduction, Electronic structure of Nanocrystals, Tuning the Band gap of Nanoscale semiconductors, Excitons, Quantum dot, Single electron devices, Nanostructured ferromagnetism, Effect of bulk nanostructuring of magnetic properties, Dynamics of nanomagnets, Nanocarbon ferromagnets, Giant and colossal magneto-resistance, Introduction of spintronics, Spintronics devices and applications.

UNIT-V (12 hrs)

5. Nanobiotechnology and Medical application: Introduction, Biological building blocks- size of building blocks and nanostructures, Peptide nanowires and protein nanoparticles, DNA double nanowires, Nanomaterials in drug delivery and therapy, Nanomedicine, Targeted gold nanoparticles for imaging and therapy.

Reference books:

1.C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.).
2.S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publishing Company).
3. K.K. Chattopadhyay and A.N. Banerjee, Introduction to Nanoscience & Technology (PHI Learning Private Limited).
4. Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).

Cluster Elective Paper-VIII-B-3: Practical: Applications of Nanomaterials and Devices 2hrs/Week

Minimum of 6 experiments to be done and recorded

1. Synthesis of metal nanoparticles by chemical route.
2. Synthesis of semiconductor nanoparticles.
3. Surface Plasmon study of metal nanoparticles by UV-Visible spectrophotometer.
4. XRD pattern of nanomaterials and estimation of particle size.
5. To study the effect of size on color of nanomaterials.
6. Prepare a disc of ceramic of a compound using ball milling, pressing and sintering, and study its XRD.
7. Fabricate a thin film of nanoparticles by spin coating (or chemical route) and study transmittance spectra in UV-Visible region.
8. Fabricate a pn-diode by diffusing Al over the surface of n-type Si and study its I-V characteristics.

THREE YEAR B.Sc. DEGREE EXAMINATIONS
CHOICE BASED CREDIT SYSTEM
SIXTH SEMESTER
PART – II : PHYSICS
PAPER : VII (B) : MATERIALS SCIENCE
(w.e.f. 2018)
MODEL PAPER

TIME : 3 Hours **Max. Marks : 75**

Section – A
విభాగము – ఎ

(Essay Questions)
(వ్యాసరూప ప్రశ్నలు)

5 x 10 = 50 M

Answer All Questions.
(అన్ని ప్రశ్నలకు సమాధానములు వ్రాయుము)

1. (a) Discuss metallic and hydrogen bonding in crystals with examples.
స్ఫటికాలలో లోహ బంధము మరియు హైడ్రోజన్ బంధములను ఉదాహరణలతో వివరించుము.

OR

(b) Discuss about polymers and Bio-materials.
పాలిమర్స్ మరియు బయో పదార్థములను గూర్చి వివరించుము.

2. (a) What are different types of defects in solids? Explain the types of point defects with examples.
ఘన పదార్థములలో దోషముల రకములను తెల్పుము. బిందు దోషములలోని రకములను ఉదాహరణలతో వివరించుము.

OR

(b) State and explain Fick's laws of diffusion. How does diffusion coefficient depend on temperature?
వ్యాపనమునకు సంబంధించిన ఫిక్స్ నియమములను తెల్పి, వివరించుము. వ్యాపన గుణకము, ఉష్ణోగ్రతపై ఏ విధముగ ఆధారపడుతుందో తెల్పుము.

3. (a) Define creep. Explain the mechanism of creep in materials. Give some applications of creep.
ప్రాకుట అనగానేమి? పదార్థములలో ప్రాకుట అను ప్రక్రియను వివరించుము. ప్రాకుట యొక్క అనువర్తనములను తెల్పుము.

OR

(b) Explain about cold working and hot working states of materials.
పదార్థముల చల్లని పనిచేయు స్థితి మరియు వేడి పనిచేయు స్థితులను వివరించుము.

4. (a) Discuss Langevin's theory of diamagnetism. Derive an expression for the change of magnetic moment.
డయా అయస్కాంతత్వము నకు సంబంధించిన లాంజివాన్ సిద్ధాంతమును చర్చించుము. అయస్కాంత భ్రామకము లోని మార్పునకు సమీకరణమును ఉత్పాదించుము.

OR

(b) Draw and explain B – H curve for a ferromagnetic material. Identify retentivity and coercive fields on the curve.
ఫెర్రో అయస్కాంత పదార్థములకు సంబంధించిన B – H వక్రమును గీచి, వివరించుము. వక్రములో రిటెంటివిటి మరియు కొయార్సివ్ ప్రాంతములను గుర్తించుము.

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5. (a) Explain the mechanism of polarization. Explain the factors affecting polarization.
ధ్రువణ ప్రక్రియను వివరించుము. ధ్రువణమును ప్రభావితముచేయు అంశములను వివరించుము.

OR

(b)Explain about ferroelectric and piezo electric materials.
ఫెర్రో విద్యుత్ మరియు పీడన విద్యుత్ పదార్థములను గూర్చి వివరించుము.

Section – B
విభాగము – బి

(Short answer questions)
(స్వల్ప సమాధాన ప్రశ్నలు)

5 x 5 = 25M

Answer any five questions
ఏవేని ఐదు ప్రశ్నలకు సమాధానములు వ్రాయుము.

6. Discuss about composites.
కాంపోజిట్ లను గూర్చి చర్చించుము.

7. Distinguish between ionic and covalent bonds.
అయానిక మరియు సమయోజనీయ బంధాల మధ్య తేడాలను తెల్పుము.

8. Explain annealing with examples.
యనీలింగ్ ప్రక్రియను ఉదాహరణలతో వివరించుము.

9. Discuss briefly about line defects.
రేఖీయ దోషములను సంక్షిప్తముగ వివరించుము.

10. Mention factors affecting mechanical properties of materials.
పదార్థముల యంత్రిక ధర్మములను ప్రభావితము చేయు అంశములను తెల్పుము.

11. Define fracture. What are brittle and ductile fractures.
పగులు అనగానేమి? పెళుసైన పగులు మరియు మెత్తని పగులు అనగానేమి?

12. State and explain weiss's theory of ferromagnetism.
ఫెర్రో అయస్కాంతత్వమునకు సంబంధించిన వీస్ సిద్ధాంతమును తెల్పి, వివరించుము.

13. Discuss about ferromagnetic domains.
ఫెర్రో అయస్కాంత డొమైన్ లను గూర్చి చర్చించుము.

14. Define dielectric constant, dielectric strength and dielectric loss.
రోధక స్థిరాంకము, రోధక సత్వము మరియు రోధక క్షీణతలను నిర్వచించుము.

15. Discuss briefly about pyroelectricity.
ఫెర్రో విద్యుత్ ను గూర్చి సంక్షిప్తముగ చర్చించుము.

19/2/18

THREE YEAR B.Sc. DEGREE EXAMINATIONS (CBCS), 2017-18

VI Semester, Part-II: Physics

Paper VIII B-1, Cluster Elective: Fundamentals **of Nanoscience**

Model paper

Time: 3 hrs Max. Marks: 75

Section - A

Answer any FIVE questions from the following (5X10 = 50 M)

ఏవేని ఐదు ప్రశ్నలకు సమాధానాలిమ్ము

1. Write a note on emergence of nano science with special reference to Feynman and Drexler.

   నానో శాస్త్రము అభివృద్ధిని ఫిన్‌మెన్ మరియు డ్రెక్స్‌లేర్ పరంగా తెలపండి

2. Write a note on development of quantum structures. Explain the concept of quantum confinement.

   క్వాంటమ్ నిర్మాణాల అభివృద్ధిపై టీకా వ్రాయండి. క్వాంటమ్ కన్‌ఫైన్‌మెంట్ భావనను వివరించండి.

3. Explain the classification of nano materials giving suitable examples for each class.

   నానో పదార్థాల వర్గీకరణను తగిన ఉదాహరణలతో వివరించండి.

4. Describe the applications of carbon nanotubes.

   కార్బన్ నానో గోట్టాల అనువర్తనాలను వివరించండి,

5. Describe the various ways by which polymers can be classified.

   పాలిమర్ల వర్గీకరణలో వివిధ పద్ధతులను వివరించండి.

6. Explain with examples the process of step-growth polymerization.

   స్టెప్ - గ్రోత్ పోలీమరీ కరణమును ఉదాహరణలతో వివరించండి.

7. Discuss the transition from crystal technology to nanotechnology.

   నానో సాంకేతిక పరిజ్ఞానానికి స్ఫటిక సాంకేతిక పరిజ్ఞానం నుండి జరిగిన పరివర్తనను చర్చించండి.

8. Explain the reason for transparent Sum-screens using ZnO nanoparticles.

   ZnO నానో కణాలను సూర్యరశ్మినుండి చర్మాన్ని కాపాడేందుకు ఉపయోగించడం లో కారణాలను తెలపండి.

9. Write note on Ti and its alloys as implant material

   Ti మరియు దాని మిశ్రమలోహాల ను గూర్చి టీకా రాయండి

10. What are the various soft tissue implants? Mention the list of materials used for fabrication of these implants.

    మృదు కణజాల implants ను తెలిపి వానిని తయారుచేయడంలో ఉపయోగించే పదార్థలను పేర్కొనండి?

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B-1

Section-B

Answer any Five questions from the following (5 x 5=25 M)

ఏవేని ఐదు ప్రశ్నలకు సమాధానాలిమ్ము

11. Write a note on energy bands in insulators, semiconductors and conductors.

వాహకాలు, అర్ధ వాహకాలు మరియు బందకాల వర్గీకరణను శక్తి పట్టి ల ఆధారంగా వివరించండి.

12. Explain quantum wire.

క్వాంటమ్ తీగ ను వివరించండి.

13. What are the properties of carbon nanotubes?

కార్బన్ నానో గోట్టాల ధర్మాలను తెలపండి.

14. Write short note on Block copolymers.

Block copolymers ల గూర్చి లఘుటీకా రాయండి.

15. What are the applications of Polyethylene?

Polyethylene అనువర్తనాలను తెలపండి.

16. What are number average and weight average molecular weights of polymers?

polymer ల సగటు మరియు భార సగటు అణుభారాలు అనగా నేమి?

17. Write short note on nanoscale processes in environment.

ప్రకృతిలో నానో పరిధి పద్దతుల పై లఘు టీకా వ్రాయండి.

18. Write short note on single electron transistor.

single electron transistor అనగా నేమి?

19. What are the ceramic implant materials?

సిరామిక్ implant పదార్థలు అనగా నేమి?

20. Discuss various internal fracture fixation nano devices.

వివిధ అంతర పగుళ్ళను (లోపాలను) సరిచేసుకొను నానో పరికరాలను గూర్చి వివరించండి.

19/12/18

MODEL PAPER

THREE YEAR B.Sc. DEGREE EXAMINATION/CHOICE BASED CREDIT SYSTEM
SIXTH SEMESTER
PART-II : PHYSICS CLUSTER ELECTIVE
PAPER VIII BH-2: **SYNTHESIS AND CHARACTERIZATION OF NANO MATERIALS**

TIME: 3 HOURS MAX MARKS:75

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SECTION-A

Answer any FIVE Questions. Marks: 5x10=50

1. Define Top - Down process. Explain Ball Milling Method for synthesis of nano particals.
   పై నుండి క్రిందకు పద్ధతిని నిర్వచించుము. బాల్ మిల్లింగ్ పద్ధతి ద్వారా నానోకణాల సంశ్లేషణమును వివరింపుము.
2. Define Bottom-Up process. Explain Sol-Gel method for synthesis of nano materials?
   క్రింది నుండి పైకు పద్ధతిని నిర్వచింపుము. Sol-Gel పద్ధతి ద్వారా నానోకణాల సంశ్లేషణమును వివరింపుము.
3. Explain Composite Materials and Polymers. Write its applications.
   మిశ్రమ పదార్థములు మరియు పాలిమర్‌లను వివరింపుము. వీటి అనువర్తనాలను వ్రాయుము.
4. What are Metallic Glasses? Mention a few metallic Glasses. How are Metallic glasses prepared?
   లోహపు గాజు అనగా ఏమి? కొన్ని లోహపు గాజులను తెలుపుము. లోహపు గాజును ఏ విధంగా తయారు చేస్తారు?
5. What is meant by glass transition temperature? How glass materials are prepared?
   గాజు సంక్రమణ ఉష్ణోగ్రత అనగా ఏమి? గాజు పదార్థాలను ఏ విధముగా తయారు చేస్తారు.
6. Discuss Electronic application, optical application and Magnetic application of glasses?
   గాజు యొక్క ఎలక్ట్రానిక్ అనువర్తనాలు, దృశ్యా అనువర్తనాలు మరియు అయస్కాంత అనువర్తనాలను చర్చించుము?
7. What are Liquid crystals? Explain different Liquid Crystal phases?
   ద్రవ స్ఫటికాలు అనగా ఏమి? ద్రవ స్ఫటికాల వివిధ దశలను వివరింపుము.

8. Explain Thermal and Electrical properties of Liquid crystals?

   ద్రవస్ఫటికాల ఉష్ణ ధర్మాలు మరియు విద్యుత్తు ధర్మాలను వివరింపుము.

9. Explain the Transmission Electron Microscope (TEM)? Give the advantages of TEM.

   ట్రాన్స్‌మిషన్ ఎలక్ట్రాన్ మైక్రోస్కోపు (TEM) ను వివరింపుము. TEM ఉపయోగాలను తెలుపుము.

10. Explain Atomic force Microscope (AFM). Give the uses of AFM.

    పరమాణబలము మైక్రోస్కాపు (AFM) ను వివరింపుము. AFM ఉపయోగాలను తెలుపుము.

SECTION-B

Answer any FIVE Questions. **Marks: 5x5=25**

11. Explain Chemical vapor deposition method for Synthesis of nanomaterials.

    రసాయనిక ఆవిరుల నిక్షేపము పద్ధతి ద్వాని నానోకణాల సంశ్లేశణమును వివరింపుము.

12. How are nanomaterials produced using bacteria?

    బాక్టీరియాను ఉపయోగించి, నానోపదార్థాలను ఏ విధముగా ఉత్పత్తి చేస్తారు.

13. Explain the Electrical and Magnetic properties of Metallic Glasses.

    లోహపు గాజు యొక్క విద్యుత్తు ధర్మాలు మరియు అయస్కాంత ధర్మాలను వివరింపుము.

14. Write a short note on diffusion.

    విసరణము మీద లఘు వ్యాఖ్యను వ్రాయుము.

15. State Theories for the glass transition.

    గాజు సంక్రమణ సిద్ధాంతమును తెలుపుము.

16. Write Electro Chemical application of Glasses.

    గాజు యొక్క విద్యుత్తు రసాయన అనువర్తనాలను వ్రాయుము.

17. Discuss the applications of Liquid Crystals

    ద్రవస్ఫటికాల అనువర్తనాలను చర్చించుము.

18. What are the types of Liquid Crystals displays?

    ద్రవ స్ఫటికా డిస్‌ప్లేల రకాలు ఏవి?

19. Explain XRD characterization Technique for nano materias.

    నానో పదార్థాల కొరకు XRD అభిలక్షణ పద్ధతి ని వివరింపుము.

20. Write Electrical properties of nano materials.

    నానో పదార్థాల విద్యుత్తు ధర్మాలను వ్రాయుము.

MODEL PAPER

THREE YEAR B.Sc DEGREE EXAMINATION CHOICE BASED CREDIT SYSTEM

SIXTH SEMESTER: PART II: PHYSICS CLUSTER ELECTIVE

Paper VIII-B-3: Applications of Nanomaterials and Devices

Time: 3 Hours Max. Marks: 75

Section-A (Essay type)

Answer any Five questions **Marks: 5x10 = 50**

ఏవేని ఐదు ప్రశ్నలకు సమాధానాలిమ్ము

1. Eplain the Coulomb interaction in nanostructures and write the concept of dielectric constant for nanostructures.
   నానో రూపాల మధ్య కూలూంబ్ అన్యోన్య చర్యలను వివరించండి మరియు నానో నిర్మాణాల రోదక స్థిరాంకముల భావనను తెలపండి.
2. Explain optical properties of heterostructures and nanostructures.
   విషమ (hetero) నిర్మాణాలు మరియు నానో రూపాల దృశ ధర్మాలను వివరించండి.
3. Define Hall effect in nanostructures and explain how the carrier mobility and carrier concentration are determined in nanostructures.
   నానో రూపాల లో హాల్ ప్రభావం ను తెలిపి వాహకాల చలనం మరియు వాహకాల కణాల సాంద్రత ను ఏవిధంగా కనుగోందురో వివరించండి.
4. Explain the tunneling and hoping conductivity in nanostructures.
   నానో రూపాలలో టనలింగ్ మరియు హొపింగ్ వాహకత్వాలను వివరించండి.
5. Explain quantum dots and nano wires and their applications.
   క్వాంటమ్ బిందువులు మరియు క్వాంటమ్ తీగల అనువర్తానాల తెలపండి.
6. Explain Optical switching and optical data storage nanomaterial devices.
   Optical switching మరియు optical datastorage నానో పదార్థ పరికరాల ను గూర్చి వివరించండి.
7. Explain the electronic structure of nanocrystals and tuning of band gap of nanoscale semiconductors.
   నానో స్ఫటికాల ఎలక్ట్రానిక్ నిర్మాణం మరియు నానో పరిధి అర్ధ వాహకాల పట్టీ అంతరాన్ని మార్చడాన్ని వివరించండి.
8. What are Spintronics, spintronics devices and write their applications.
   Spintronics, spintronics పరికారలు అనగా నేమి? వాని అనువర్తాలను తెలపండి.
9. What are Peptide nanowires and protein nanoparticles and write their applications.
   Peptide nanowires and protein nanoparticles అనగా నేమి? వాని అనువర్తాలను తెలపండి.
10. Explain the role of nanomaterials in drug delivery and therapy.
    రోగ చికిత్స లో మందుల సరఫరా చేయడంలో నానో పదార్థల పాత్రను విశదీకరించండి.

19/12/18

Section-B (Short answer type)

Answer any Five questions **Marks: 5 x5 = 25**
ఏవేని ఐదు ప్రశ్నలకు సమాధానాలిమ్ము

11. What are quasi-particles and excitons? Explain.
quasi-particles మరియు excitons అనగా నేమి ? వానిని గూర్చి వివరించండి .

12. Explain the process of luminescence in nanomaterials.
నానో పదార్థాలలో ప్రతి దీప్తి ప్రక్రియను వివరించండి .

13. Explain the Coulomb blackade effect.
Coulomb blackade ప్రభావం అనగా నేమి ?

14. Write short note on thermionic emission in nanostructures.
నానో రూపాలలో జరిగే ఉష్ణ ఉత్సర్గం గూర్చి లఘు టీకా వ్రాయండి ?

15. What are CNT based transistors? Explain.
CNT ఆధార transistors అనగా నేమి ? వివరించండి .

16. What are MEMS? Write their applications.
MEMS అనగా నేమి ? వాటి అనువర్తనాలను తెలపండి.

17. Explain nanostructured ferromagnetism.
నానో రూప ఫేర్రో అయస్కాంతత్వమును వివరించండి.

18. Explain the dynamics of nanomagnets.
నానో అయస్కాంతాల గతిశీలతను వివరించండి.

19. What are DNA double nanowires? Write their applications
DNA double నానో తీగలు అనగా నేమి ? వాని అనువర్తనాలను తెలపండి .

20. Explain medical application of targeted gold nanoparticles.
targeted బంగారు నానో కణాల వైద్యశాస్త్ర అనువర్తనాలను తెలపండి .

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19/2/18